DESIGN GUIDELINE 3.6
CARBON MAXIMUM EMISSIONS TARGETS

Scope

This Design Guideline applies to new buildings and building additions as well as major renovation projects over $10 million construction cost at the Ann Arbor, Dearborn and Flint campuses.

Determine carbon maximum emissions targets as described herein. Throughout the design process, meetings are to be held to evaluate how the project is meeting the project's maximum carbon emissions targets and to review the carbon reduction measures specific to the project.

Related Sections

U-M Design Guideline Sections:
1.0 Codes and Regulatory Agencies (for energy code requirements)
2.1 Owner's Project Requirements and Basis of Design Documents
3.2 Energy and Water Conservation Measures and Carbon Reduction

Reference Documents:
Building Infrastructure Table
Building Type Definitions and Maximum Emissions Table

Carbon Reduction Compliance

The following project types are required to comply with the university's carbon reduction targets:

- All new building projects
- All new addition projects
- Major renovation projects over $10 million construction cost

Projects required to comply with carbon reduction targets are to perform the following:

(a) Determine the percentage of area associated with each Building Type included in the project scope as described herein.
(b) Calculate the project specific Building Maximum Emissions Target as described herein.

Building Type Percentages

Maximum emissions targets have been established for several different building types including Administration, Athletics, Clinical, Education, Library, and Residential. Some of these types are further broken down to account for differences in energy and carbon intensity. Determine the percentage of project area, based on net-square-feet, associated with each Building Type included in the project scope.

Document the percentage of each building use type and a breakdown of programmatic spaces included with each type in accordance with the Documentation Requirements listed below.

Building Infrastructure

Each building type includes a brief definition, building infrastructure information (e.g. occupancy, HVAC design, ventilation and process exhaust, electrical plug and process load, and lighting) and example space types to assist the design team in identifying use types included in the project scope. Building infrastructure definitions included in each use type are described in the table below.

Building Infrastructure			
Occupancy:	**Low:** Low density (ppl/sf), low utilization due to schedule or controls	**Medium:** Medium density (ppl/sf), medium utilization	**High:** High density (ppl/sf), high utilization 24-7-365
HVAC Design:	**Low Intensity**: Low pressure systems, low percent outside air, low heating and cooling loads, minimal temperature and humidity control	**Medium Intensity:** Combination of low and high systems	**High Intensity:** High pressure systems, high percent outdoor air, high heating and/or cooling loads, tight temperature and humidity control
Ventilation and Process Exhaust:	**Low Outdoor Airflow:** Little or no process exhaust, ventilation driven by low to medium intensity occupancy.	**Medium Outdoor Airflow:** Combination of low and high airflow, ventilation driven by high intensity occupancy.	**High Outdoor Airflow:** High density of fume hoods or process exhaust resulting in 2 or more cfm/sf of continuous exhaust.
Electrical Plug and Process Loads:	**Low Density:** No process load, low outlet quantity; low equipment utilization and/or peak load	**Medium Density:** In-between or combination of low and high loads	**High Density:** Significant process load and high outlet quantity; high equipment utilization and/or peak load

Lighting:	**Low:** Supports tasks related to everyday functions, with low difficulty, large details, low hazards, and similar	**Medium:** Supports tasks related to medium level difficulty, medium details, enhanced hazards, and similar	**High:** Supports tasks that are exacting, or related to fine details, high hazards, and similar

Building Types

Utilize the definitions included below to determine the percentage (based on Net Square Feet) of each building type included in the project scope.

Building areas that are shared across different building use types are to be excluded from the overall calculations. These shared spaces may include but are not limited to the following:

- Circulation spaces (corridors, elevator lobbies, stairwells, etc.)
- Support facilities (restrooms, janitor closets, storage, mechanical rooms, etc.)
- Shared spaces (atria, personal rooms, reflection rooms, kitchenettes, etc.)

Building types are described in the following tables.

Building Type:	**Administration**
	Office and meeting space with conventional A/V systems such as screen, projector
Occupancy:	Medium
HVAC Design:	Medium Intensity
Ventilation and Process Exhaust:	Low Outdoor Airflow
Electrical Plug and Process Loads:	Medium Density
Lighting:	Medium
Typical Space Types:	Private Offices; Multi-Person Office; Open Office; Conference Rooms; Kitchenettes (non-commercial kitchens)

Building Type:	**Athletics**		
	Low Intensity	**Medium Intensity**	**High Intensity**
	Facilities used for athletic varsity practice and/or recreational athletic competitions (i.e., not designed for spectator comfort, systems designed for primary use and not special events)	Varsity team headquarters and recreational sport facilities. .	Facilities used for varsity competitions, natatoria with deck and associated locker rooms, and sports medicine facilities that include therapy pools for training, conditioning and rehabilitation.
Occupancy:	Low	Medium	Medium
HVAC Design:	Low Intensity	Medium Intensity	High Intensity
Ventilation and Process Exhaust:	Low Outdoor Airflow	Medium Outdoor Airflow	High Outdoor Airflow
Electrical Plug and Process Loads:	Low Density	High Density	Medium Density
Lighting:	Medium	Medium	High
Typical Space Types:	Field Houses; Indoor Practice Facilities	Varsity Team Facilities; Locker Rooms; Recreational Sports; Athletic Medicine	Competition Facilities w/ Spectators; Natatoria; Ice Arenas; Special areas with high intensity process loads (e.g. indoor row tanks)

Building Type:	**Clinical**		
	Outpatient Business	**Outpatient Ambulatory**	**Inpatient**
	Typical outpatient clinical space with exam rooms and offices	Clinical space with ambulatory arrival	Inpatient clinical space
Occupancy:	Low	Medium	Medium
HVAC Design:	Low Intensity	Medium Intensity	High Intensity
Ventilation and Process Exhaust:	Low Outdoor Airflow	Medium Outdoor Airflow	High Outdoor Airflow
Electrical Plug and Process Loads:	Low Density	Medium Density	High Density
Lighting:	Low	Medium	High
Typical Space Types:	Exam Rooms; Office/Support Spaces; Pharmacy-Dispensary; Infusion; Diagnostic Testing	Diagnostic Imaging; Ambulatory Surgery	Inpatient Beds; Operating Rooms; Inpatient Surgeries; Intensive Care Units (ICU); Acute Care Units; Step Down Units; Isolation Units; Observation Units; Pharmacy-Compounding Spaces

Building Type:	**Education**		
	No Lab	**Low Load Lab**	**High Load Lab**
	Low-tech instructional space with conventional A/V systems (such as screen, projector, etc.)	Active learning with high-tech/ energy-intensive A/V equipment, and/or non-wet laboratory equipment	Instructional and/or research laboratory spaces, energy intensive equipment
Occupancy:	Medium	Medium	Medium
HVAC Design:	Low Intensity	Medium Intensity	High Intensity
Ventilation and Process Exhaust:	Low Outdoor Airflow	Medium Outdoor Airflow	High Outdoor Airflow
Electrical Plug and Process Loads:	Low Density	Medium Density	High Density
Lighting:	Low	Medium	High
Typical Space Types:	Typical Classrooms; Typical Auditoriums	Dry Labs; Active Learning Classrooms; Computer Labs	Wet Labs; Lab Equipment Spaces; Cold Rooms

Building Type:	**Library**
	Traditional library space with book storage, fixed/ flexible seating (building type does not include the following: food service, instructional spaces, computing spaces, etc.)
Occupancy:	Low
HVAC Design:	Low Intensity
Ventilation and Process Exhaust:	Low Outdoor Airflow

Electrical Plug and Process Loads:	Low Density
Lighting:	Medium
Typical Space Types:	Library Book Stacks; Reading Rooms; Study Rooms

Building Type:	**Residential**	
	Dormitory	**Low-Rise, Duplex, Single Family**
	Student housing (includes support spaces except dining and commercial kitchens)	Low-density housing with residential kitchens and bath rooms
Occupancy:	Medium	Medium
HVAC Design:	Low Intensity	Low Intensity
Ventilation and Process Exhaust:	Low Outdoor Airflow	Low Outdoor Airflow
Electrical Plug and Process Loads:	Low Density	Low Density
Lighting:	Low	Low
Typical Space Types:	Dormitory Rooms; Lounges; Study Rooms; Shower Rooms; Restrooms; Self-Service Laundry Facilities	Family/ Student Housing

The Design Manager will work with the Design Professional in situations where other uses do not explicitly fit into an existing building type (such as dining facilities, vivarium, collection spaces, etc.). Targets for "other" building types will be determined on a project-by-project basis through evaluating infrastructure requirements, comparing those needs to the building types defined in this document, and establishing a target based on the most compatible building types.

Building Maximum Emissions Targets

Each building use category has an associated fixed value maximum emissions target and a maximum emissions target derived from a percent reduction from an ASHRAE baseline.

Projects will be required to meet either the project specific fixed value maximum emissions target or a maximum emissions target derived from a percent reduction from ASHRAE, whichever is more stringent.

Maximum Emissions Targets for each building use category are listed in the tables below.

Building Type:	**Administrative**
Fixed Value Maximum Carbon Emissions Goal:	10 kg CO2/sqft
ASHRAE % Reduction Maximum Carbon Emissions Goal:	33.3%

Building Type:	**Athletics**		
	Low Intensity	**Medium Intensity**	**High Intensity**
Fixed Value Maximum Carbon Emissions Goal:	7 kg CO2/sqft	10 kg CO2/sqft	16 kg CO2/sqft
ASHRAE % Reduction Maximum Carbon Emissions Goal:	28.6%	23.8%	25.0%

Building Type:	**Clinical**		
	Outpatient Business	**Outpatient Ambulatory**	**Inpatient**
Fixed Value Maximum Carbon Emissions Goal:	10 kg CO2/sqft	15 kg CO2/sqft	21 kg CO2/sqft
ASHRAE % Reduction Maximum Carbon Emissions Goal:	28.6%	21.1%	25.0%

Building Type:	**Educational**		
	No Lab	**Low Load Lab**	**High Load Lab**
Fixed Value Maximum Carbon Emissions Goal:	10 kg CO2/sqft	16 kg CO2/sqft	21 kg CO2/sqft
ASHRAE % Reduction Maximum Carbon Emissions Goal:	28.6%	23.8%	25.0%

Building Type:	**Library**
Fixed Value Maximum Carbon Emissions Goal:	6 kg CO2/sqft
ASHRAE % Reduction Maximum Carbon Emissions Goal:	20.0%

Building Type:	**Residential**	
	Dormitory	**Low-Rise, Duplex, Single Family**
Fixed Value Maximum Carbon Emissions Goal:	5.2 kg CO2/sqft	1 kg CO2/sqft
ASHRAE % Reduction Maximum Carbon Emissions Goal:	34.2%	77.8%

Project Specific Building Emissions Target

Project specific maximum emissions targets will be derived from a weighted average using the percentage of GSF for each of the project's building types.

Weighted Average Calculations

(a) Calculate weighted average emissions target using fixed values
(b) Calculate weighted average emissions target using ASHRAE % reduction

(c) Compare the weighted average emissions target of both the fixed value and the % reduction from ASHRAE. Projects will work with the Design Manager to determine the most appropriate emissions target.
(d) Document the project specific maximum carbon emissions target in accordance with the Documentation Requirements listed below.

Documentation Requirements

Provide documentation in accordance with Design Guideline 2.1, Design Deliverables, Design Guideline 3.2 Carbon Reduction and Energy and Water Conservation and as follows.

Starting at the Predesign or early Schematic Design phase, provide the following information.

(a) Document the percentage of each building use type and a breakdown of programmatic spaces included with each building type. This is to be included in the Owner's Project Requirements and Basis of Design (OPR/BOD) document.
(b) Weighted average calculations and project specific building emissions target. This is to be included in the OPR/BOD document.
(c) Energy model output and calculations to demonstrate compliance with the project specific maximum carbon emissions target.

Update and submit energy model output documentation at the end of Schematic Design (SD), Design Development (DD), Construction Documents (CD) phases. Also, update and submit final energy output documentation after project award to reflect accepted Alternates and Owner's Options.